

# PATENT COOPERATION TREATY

*JB*

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:  
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## PCT NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing  
(day/month/year) **02 MAY 2007**

Applicant's or agent's file reference

2004UR013

### IMPORTANT NOTIFICATION

International application No.

PCT/US05/17363

International filing date (day/month/year)

17 May 2005 (17.05.2005)

Priority date (day/month/year)

20 May 2004 (20.05.2004)

Applicant

EXXONMOBIL UPSTREAM RESEARCH COMPANY

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

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Form PCT/IPEA/416 (July 1992)

Authorized officer

*Carl Friedman*  
Carl Friedman

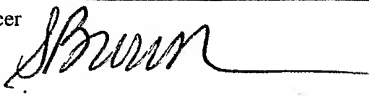
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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2004UR013	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US05/17363	International filing date (day/month/year) 17 May 2005 (17.05.2005)	Priority date (day/month/year) 20 May 2004 (20.05.2004)
International Patent Classification (IPC) or national classification and IPC IPC: E04G 21/00( 2006.01);E04B 5/00( 2006.01) USPC: 52/745.02,67,79.1,334,284,414,270,796.1,794.1,650.3		
Applicant EXXONMOBIL UPSTREAM RESEARCH COMPANY		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>3</u> sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of report with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand 22 March 2006 (22.03.2006)	Date of completion of this report 30 March 2007 (30.03.2007)	
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Carl Friedman  Telephone No. (571) 272-6848	

Form PCT/IPEA/409 (cover sheet)(July 1998)

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US05/17363

**I. Basis of the report****1. With regard to the elements of the international application:\***

- ☐ the international application as originally filed.
- ☒ the description:  
pages 1-9,11-17,19-20 as originally filed  
pages NONE, filed with the demand  
pages 10,18, filed with the letter of 22 March 2006 (22.03.2006).
- ☒ the claims:  
pages 21-25 and 27 as originally filed  
pages NONE, as amended (together with any statement) under Article 19  
pages NONE, filed with the demand  
pages 26, filed with the letter of 22 March 2006 (22.03.2006).
- ☒ the drawings:  
pages 1-8 as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☐ the sequence listing part of the description:  
pages NONE as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

**3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:**

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**4. ☐ The amendments have resulted in the cancellation of:**

- ☐ the description, pages NONE
- ☐ the claims, Nos. NONE
- ☐ the drawings, sheets/fig NONE

**5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/US05/17363

## V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. STATEMENT

Novelty (N)	Claims <u>1-25</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1-25</u>	YES
	Claims <u>NONE</u>	NO
Industrial Applicability (IA)	Claims <u>1-25</u>	YES
	Claims <u>NONE</u>	NO

### 2. CITATIONS AND EXPLANATIONS

Claims 1-25 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a containment system comprising a floor slab, a primary container positioned on the floor slab and a secondary container peripherally positioned around the primary container, the secondary container comprising a plurality of joined steel-concrete wall panels attached to the floor slab.

Claims 1-25 meet the criteria set out in PCT Article 33(4), and thus claims 1-25 meet industrial applicability because the subject matter claimed can be made or used in industry.

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[0054] **Figure 1** presents a perspective, cutaway view of a containment structure 100, in one embodiment. The containment structure 100, in its most general form, comprises an external secondary container 200 and at least one inner primary container 300. A primary container 300 is seen in the cutaway portion of the secondary container 200. The primary container 300 is designed to hold liquefied natural gas ("LNG") at cryogenic temperature and in an insulated manner. At the same time, the secondary container 200 is designed to serve as a "back-up" to the primary container 300 in the event that the primary container 300 loses fluid integrity.

[0055] A secondary container of an LNG storage system fulfills several functions. During normal operations, the outer, or "secondary" container holds the insulation in place and provides protection to the inner, primary tank against the elements of nature. Under extreme conditions when the inner tank is assumed to fail and no longer able to hold the cryogenic liquid, the outer tank is called upon to hold full contents of the inner tank safely and to permit both controlled withdrawal of the contained liquid and controlled release of the product vapor. In this event, a severe set of loads is imposed on the outer tank. Not only is the outer tank subjected to the hydrostatic loads applied by the liquid now contained by it, but the outer wall is also subjected to a 'thermal shock' loading due to sudden exposure to the very low temperatures of the LNG liquid. The inner wall and floor surfaces of the secondary container experience a sudden and severe drop of temperature while the outer surfaces of the secondary container wall remain exposed to ambient temperature. This causes severe stresses in the secondary container at junctures such as wall-floor interfaces. Thus, a secondary container 200 is preferably designed to accomplish one or more of the following: (1) withstand hydrostatic forces upon fluid leakage from the primary container 300, (2) contain liquids that might escape from the primary container 300, (3) provide gas tightness from gases that will form when liquid escapes from the primary container 300, and (4) withstand thermal shock created if and when extremely cold fluids from the primary container 300 contact the inner surfaces of the secondary container 200.

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by pouring concrete on top of the steel plate 264 of the roof building block. Post tensioning of the roof concrete layer 266 may not be necessary in these arrangements.

[0079] In addition to providing a secondary container for an LNG containment system 100, a method is also provided herein for assembling an LNG containment system, such as system 100. Construction of containment system 100 is expedited by using the above-described secondary container embodiments 200. The secondary container 200 is erected over a concrete tank floor (seen at 250 in FIG. 1). More specifically, individual walls, e.g., end walls 212, 214 and side walls 222, 224 are formed by vertically erecting and attaching various panels (shown at 230 in FIG. 3) side-by-side. This is a segmental technique that uses off-site prefabrication of building blocks that can be assembled into a structural system.

[0080] Known full containment systems typically demand a relatively long construction schedule. The sequential construction of storage system elements normally starts with the construction of a cast-in-place outer tank slab and walls. Only after the domed roof has been constructed on the outer tank walls is construction on the internal structures, including the bottom insulation and inner steel tank, started. This means that the inner steel tank is constructed in-situ after the secondary container has been at least substantially completed. A construction schedule of 36 months for a now typical 160,000 m<sup>3</sup> full containment LNG storage tank is normal. This long construction schedule is often on the critical path for an LNG facility construction project, causing a potential source of delay. Therefore, an improved method for assembling an LNG containment system is offered.

[0081] Figures 9A-9F present sequential steps for construction of a full containment LNG tank 100, in one embodiment. The full containment tank 100 will include one or more inner tanks 300 and a surrounding outer tank 200. First, Figure 9A shows the formation of a concrete floor slab 250. In this embodiment, the "footprint" of the slab 250 is rectangular. In addition, a vertical end wall 212 has been erected over an end of the floor slab 250. The end wall 212 has been assembled by adjoining prefabricated combination wall panels (such as those shown at 230 in Figure 3) in side-to-side fashion. The wall panels 230' may be individual wall

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erecting at least one final vertical wall on the floor slab so as to form a polygon having at least four sides and so as to enclose the primary container within the secondary container.

20. A wall panel for a secondary container, the secondary container being employed with a full containment LNG system, the wall panel comprising:
- a concrete plate having an inner surface, an outer surface, and a longitudinal axis;
  - at least one steel beam connected to the concrete plate along the outer surface of the concrete plate, and along the longitudinal axis; and
  - wherein the wall panel is configured so that a plurality of wall panels may be adjoined in side-to-side fashion so as to form a wall of a secondary container for the full containment LNG system.
21. The wall panel of claim 20, further comprising:
- a moisture barrier disposed on the concrete plate opposite the at least one steel beam.
22. The wall panel of claim 21, further comprising:
- an insulation layer along the moisture barrier opposite the at least one steel beam; and
  - a liner plate on the insulation layer.
23. A roof panel for a secondary container, the secondary container being employed with a full containment LNG system, the roof panel comprising:
- an elongated steel truss structure;
  - a barrier layer placed over the steel truss structure;
  - at least one thin concrete plate placed over the barrier layer along a longitudinal axis of the concrete plate; and